Meridian 1

Intelligent peripheral equipment circuit cards for Austria

Option 11 - Description and Installation

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About this document

This document is a Supplement to the Option 11 *Installation guide* 553-3011-210. It describes the functions and applications of the following circuit cards that are available for use in Austria:

- NT5K70AB Central Office Trunk card (8-unit)
- NT5K71AB Central Office Trunk card (4-unit)
- NT5K72AA E&M Tie Trunk card
- NT5K36AB Direct Inward Dial/Direct Outward Dial Trunk card.
- NT5K92AA Direct Inward Dial Auto Answer Circuit.

~~NT5K93~~ Central office trunk circuit cards

Functional description

The NT5K70AB Central Office trunk card for Austria provides the interface between the Option 11 system and up to eight analog Central Office (CO) trunks. The NT5K71AB Central Office trunk card is the same as the NT5K70AB trunk card, but connects up to four analog trunks instead of eight.

The NT5K70AB and NT5K71AB trunk cards can be installed in slots 1 to 10 in the main cabinet and in any slot in the expansion cabinet.

Common features

The NT5K70AB and NT5K71AB Central Office trunk cards:

- support internal 16 kHz periodic pulse metering (PPM)
- allow individual units or the entire board to be disabled by software
- provide software selectable A-law companding
- indicate self-test status during an automatic or manual self-test
- convert transmission signals from analog-to-digital and from digital-to-analog
- provide 2 dB transmission pads for long/short line operation
- provide termination and transhybrid balance impedance to match the German complex impedance network
- provides busy tone detection on a per unit basis, when configured to do so in software

- provides 100 ms Flashhook for feature access
- provide direct reporting of Periodic Pulse Metering (PPM) pulses to software in either buffered or unbuffered format.

Physical description

Switch settings

There are no option switches on either the NT5K70AB or the NT5K71AB Central office trunk card. All settings are configured in software.

Connections

Each unit on the NT5K70AB/NT5K71AB card connects to the shelf backplane through an 80-pin connector. The backplane is cabled to the input/output (I/O) panel which is then cabled to the cross-connect terminal.

At the cross-connect terminal, each unit connects to external apparatus by Tip and Ring leads.

Installation

Tables 1 and 2 provide cross connect information for the NT5K70 and NT5K71 Central Office trunk cards.

Table 1
NT5K70 Central Office Trunk connections

Lead	Pins	Pair color	Unit number
T0 R0	26 1	W-BL BL-W	Unit 0
	27 2	W-O O-W	
T1 R1	28 3	W-G G-W	Unit 1
	29 4	W-BR BR-W	
T2 R2	30 5	W-S S-W	Unit 2
	31 6	R-BL BL-R	
T3 R3	32 7	R-O O-R	Unit 3
	33 8	R-G G-R	
T4 R4	34 9	R-BR BR-R	Unit 4
	35 10	R-S S-R	
T5 R5	36 11	BK-BL BL-BK	Unit 5
	37 12	BK-O O-BK	
T6 R6	38 13	BK-G G-BK	Unit 6
	39 14	BK-BR BR-BK	
T7 R7	40 15	BK-S S-BK	Unit 7
	41 16	Y-BL BL-Y	

Table 2
NT5K71 Central Office Trunk connections

Lead	Pins	Pair color	Unit number
T0 R0	26 1	W-BL BL-W	Unit 0
	27 2	W-O O-W	
	28 3	W-G G-W	
	29 4	W-BR BR-W	
T1 R1	30 5	W-S S-W	Unit 1
	31 6	R-BL BL-R	
	32 7	R-O O-R	
	33 8	R-G G-R	
T2 R2	34 9	R-BR BR-R	Unit 2
	35 10	R-S S-R	
	36 11	BK-BL BL-BK	
	37 12	BK-O O-BK	
T3 R3	38 13	BK-G G-BK	Unit 3
	39 14	BK-BR BR-BK	
	40 15	BK-S S-BK	
	41 16	Y-BL BL-Y	

Self-test

When the NT5K70AB/NT5K71AB trunk card is installed and power is applied to it, a self-test is performed on the card. The red LED on the faceplate flashes three times, then remains continuously lit until the card is enabled in software. If the self-test fails, the LED will remain lit.

Technical description

The technical details of the NT5K93 Central office trunk card are outlined below.

Power requirements

Table 3 lists the power requirements for the NT5K70AB trunk card, Table 4 lists the power requirements for the NT5K71AB trunk card.

Table 3
Power requirements for the NT5K70AB card

Voltage	Idle current	Active current
± 15.0 V dc (see note 1)	160 ma	250 ma
+ 8.5 V dc (see note 2)	120 ma	120 ma
+ 5.0 V dc	220 ma	350 ma

Table 4
Power requirements for the NT5K71AB trunk card

Voltage	Idle current	Active current
± 15.0 V dc (see note 1)	100 ma	150 ma
+ 8.5 V dc (see note 2)	100 ma	100 ma
+ 5.0 V dc	150 ma	220 ma

Note 1: Analog circuitry is powered with +/- 12V generated from +/- 15V. The maximum current imbalance between the +/- 15V rails is 100 ma per circuit pack.

Note 2: 8.5V is regulated to give 5V.

Environmental specifications

Table 5 lists the environmental specifications for the NT5K70AB and NT5K71AB trunk cards

Table 5
Environmental specifications for NT5K70AB and NT5K71AB

Parameter	Specifications
Operating temperature	0 to 40 degrees C, ambient
Operating humidity	10 to 95 % Relative Humidity
Storage temperature	- 45 to + 70 degrees C
Storage humidity	0 to 95% Relative Humidity

Transmission parameters

Loss values for the NT5K70AB and NT5K71AB trunk cards are given in Table 6. Pads are switched by software, with the default being the Pad OUT condition.

Table 6
NT5K70AB/NT5K71AB Pad switching

	Pad IN (Short Line)	Pad OUT (Long Line)
Analog-to-Digital loss	-5.0 dB	-7.0 dB
Digital-to-Analog loss	+2.0 dB	0 dB

Note: The tolerance for the above nominal values is +/- .55 dB.

Trunk types description

Each NT5K70AB/NT5K71AB Central office trunk card supports:

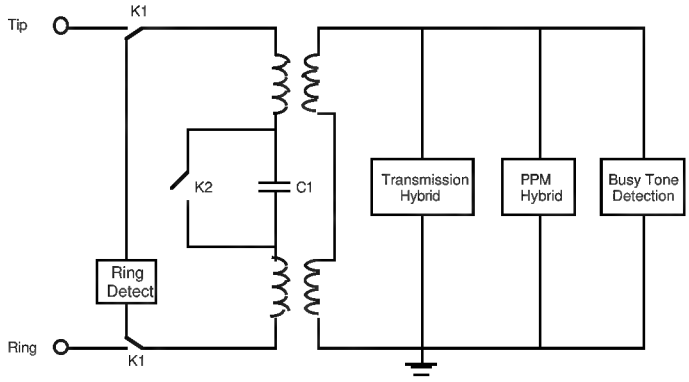
- Loop start operation
- 16 kHz Periodic Pulse Metering (PPM), also referred to as Subscriber Pulse Metering (SPM)
- Busy tone detection and supervision (call disconnect).

For information on features and signaling arrangements, see *Generic X11 including supplementary features* (PO730484 or NTCK09 in the UK).

Loop start operation

Loop start operation is configured in software and is implemented in the card through software download messages. Loop start operation for the NT5K70AB and NT5K71AB trunk cards is shown in Figure 1.

Figure 1
NT5K70AB/NT5K71AB loop start operation



Idle state

In the idle state, the central office trunk card provides a high impedance loop toward the central office. The ringing detector is connected across the tip and ring leads.

Call placed by central office

The Central Office initiates a call by applying ringing voltage between the tip and ring leads. If the call is answered, relay K1 changes over, thus switching out the ringing detector and placing a low resistance loop between the tip and ring leads.

Call placed by Option 11

To initiate a call, the Option 11 activates relay K1, which switches out the ringing detector and places a low resistance loop across the tip and ring leads. The Option 11 sends digits in the form of Dual Tone Multifrequency (DTMF) tones or pulse digits. Pulse digits are generated by opening and closing Relay K2.

Call disconnect

If Busy Tone detection is configured in LD 14, the central office can disconnect a call by sending the Busy Tone signal. When the central office trunk card receives this signal, a disconnect message is sent to software.

The Option 11 disconnects the call by opening Relay K2 and removing the dc loop. The low impedance ac path remains for 2 seconds to present metering pulses. After 2 seconds, Relay K1 times out, breaking the ac path and re-connecting the ringing detector across the tip and ring leads.

Features description

Periodic Pulse Metering (PPM)

All trunk units on the NT5K70AB/NT5K71AB card support the Periodic Pulse Metering (PPM) feature, or Subscriber Pulse Metering (SPM), as it is sometimes called.

Periodic Pulse Metering allows the user of a telephone on an Option 11 to keep an accurate record of central office calls for billing or administration purposes.

Note: PPM is configured on a per unit basis.

For more information on PPM, refer to *Generic X11 Including Supplementary Features appendix 2 to 553-2311-105.*

E&M tie trunk circuit card

Functional description

The NT5K72AA E&M Tie trunk card for Austria provides the interface between the Option 11 system and up to four analog trunks. It can be installed in slots 1 to 10 in the main cabinet and in any slot in the expansion cabinet.

The NT5K72AA E&M Tie trunk card supports four analog trunks. Each trunk circuit can be individually configured as:

- 4-wire E&M Type 1 and 2
- Recorded Announcement trunk (RAN)
- Music trunk (MUS)
- Paging trunk (PAG)

Common features

The NT5K72AA E&M Tie trunk card:

- converts transmission signals from analog-to-digital and from digital-to-analog
- provides software selectable A-law or μ-law operation
- enables and disables individual units or the entire card under software control
- provides outpulsing on the card. Make break ratios are defined in software and downloaded during power up and by software commands.

- provides indication of card status from self-test diagnostics on the LED
- allows trunk type to be configured through service change or on a per unit basis
- provides termination against 600 ohms for 4-wire E&M trunk circuits
- provides paging (PAG), recorded announcement (RAN), and Music (MUS) interfaces.

Physical description

Measurements

Each NT5K83CA E&M Tie trunk card measures 12.5 in. (320 mm) in height by 10 in. (255 mm) in depth.

Switch settings

There are no option switches on the NT5K72AA E&M Tie trunk card. All settings are configured in software.

Connections

The NT5K72AA E&M Tie trunk card has four units. Each unit connects to the shelf backplane through an 80-pin connector. The backplane is cabled to the input/output (I/O) panel which is then cabled to the cross-connect terminal.

At the cross-connect terminal, each unit connects to external apparatus by tip and ring leads. For detailed termination and cross-connect information, see *System installation procedures (553-3001-210).*

Installation

Tables 1 to 4 provide cross connect information for the NT5K72 E&M Tie trunk card.

Table 7
NT5K72 E&M 4-Wire Type 1 connections

Lead designations	Pins	Pair color	Unit number
RA RB	26 1	W-BL BL-W	Unit 0
TA TB	27 2	W-O O-W	
E M	28 3	W-G G-W	
RA RB	30 5	W-S S-W	Unit 1
TA TB	31 6	R-BL BL-R	
E M	32 7	R-O O-R	
RA RB	34 9	R-BR BR-R	Unit 2
TA TB	35 10	R-S S-R	
E M	36 11	BK-BL BL-BK	
RA RB	38 13	BK-G G-BK	Unit 3
TA TB	39 14	BK-BR BR-BK	
E M	40 15	BK-S S-BK	

Note: The cable pair designated TA, TB is the transmit pair. The pair designated RA, RB is the receive pair.

Table 8
NT5K72 E&M 4-Wire Type 2 connections

Lead designations	Pins	Pair color	Unit number
RA RB	26 1	W-BL BL-W	Unit 0
TA TB	27 2	W-O O-W	
EA EB	28 3	W-G G-W	
MA MB	29 4	W-BR BR-W	
RA RB	30 5	W-S S-W	Unit 1
TA TB	31 6	R-BL BL-R	
EA EB	32 7	R-O O-R	
MA MB	33 8	R-G G-R	
RA RB	34 9	R-BR BR-R	Unit 2
TA TB	35 10	R-S S-R	
EA EB	36 11	BK-BL BL-BK	
MA MB	37 12	BK-O O-BK	
RA RB	38 13	BK-G G-BK	Unit 3
TA TB	39 14	BK-BR BR-BK	
EA EB	40 15	BK-S S-BK	
MA MB	41 16	Y-BL BL-Y	

Note: The cable pair designated TA, TB is the transmit pair. The pair designated RA, RB is the receive pair.

Table 9
NT5K72 E&M Voice Paging connections

Lead designations	Pins	Pair color	Unit number
T0 R0	27 2	W-O O-W	Unit 0
A PG	29 4	W-BR BR-W	
T1 R1	31 6	R-BL BL-R	Unit 1
A PG	33 8	R-G G-R	
T2 R2	35 10	R-S S-R	Unit 2
A PG	37 12	BK-O O-BK	
T3 R3	39 14	BK-BR BR-BK	Unit 3
A PG	41 16	Y-BL BL-Y	
Note: The cable pair designated TA, TB is the transmit pair. The pair designated RA, RB is the receive pair.			

Table 10
NT5K72 E&M Recorded Announcement connections

Lead designations	Pins	Pair color	Unit number
T0 R0	26 1	W-BL BL-W	Unit 0
SIG B SIG A	29 4	W-BR BR-W	
T1 R1	30 5	W-S S-W	Unit 1
SIG B SIG A	33 8	R-G G-R	
T2 R2	34 9	R-BR BR-R	Unit 2
SIG B SIG A	37 12	BK-O O-BK	
T3 R3	38 13	BK-G G-BK	Unit 3
SIG B SIG A	41 16	Y-BL BL-Y	
Note: The cable pair designated TA, TB is the transmit pair. The pair designated RA, RB is the receive pair.			

Self-test

When the NT5K72AA E&M Tie trunk card is installed and power is applied to it, a self-test is performed on the card. The red LED on the NT5K72AA faceplate flashes three times, then remains continuously lit until the card is enabled in software. If the self-test fails, the LED will remain lit after the card is enabled.

Trunk configuration

Route Data Block

Each trunk unit on the NT5K72AA E&M trunk card is attached to a route with an associated route data block. The route data block is programmed in overlay 16.

Note: All prompts are default except for those noted in Table 5.

Table 11
LD 16 Route Data Block

Prompt	Response	Comments
REQ	NEW	
TYPE	RDB	Define a new Route Data Block
CUST	0-99	Enter customer number
ROUT	0-127	Enter route number
TKTP	TIE, (RAN), (PAG), (MUS)	Trunk type is Tie, (Recorded Announcement), (Paging), or (Music)
RTYP		RAN Type
REP	1-15	Number of repetitions (RAN)
POST	DIS, ATT	After maximum repetitions (RAN):
		Disconnect (DIS), or Route to Attendant (ATT)
STRT	IMM, DDL	Connect call to recording immediately (IMM), or at start of recording (DDL)
ACOD	XXXXXXX	Trunk route access code
ICOG	ICT, OGT, IAO	Incoming trunk (ICT), Outgoing trunk (OGT, or both (IAO)
NEDC	ETH, (ORG)	Near end disconnect control from either side, or (originating) end
FEDC	ETH, (ORG)	Far end disconnect control from either end, or (originating) end

Trunk Data Block

Use overlay 14 to configure each of the trunk units on the NT5K72AA E&M trunk.

Table 12
LD 14 Route Data Block

Prompt	Response	Comments
REQ	NEW	Define a new trunk unit
TYPE	TIE, (RAN), (PAG), (MUS)	Trunk type is Tie, (Recorded Announcement), (Paging), or (Music)
TN	CC UU	Terminal number of the unit in Option 11 format Card, Unit
XTRK (see note)	XFEM	Type is IPE E&M
EMTY	TY1, (TY2)	Type 1 signaling, (Type 2)
TIMP	1200	Terminating impedance 1200 Ohms (RAN)
SIGL	EM4	4 wire E&M speech
STRI	IMM, (WNK), (DDL)	Incoming start Immediate, (Wink), (Delayed dial)
STRO	IMM, (WNK), (DDL)	Outgoing start Immediate, (Wink), (Delayed dial)
SUPN	YES, (NO)	Answer and disconnect supervision enabled, (disabled)
CLS	(NTC), (VNL)	PABX-PABX, International Leased Line
	DTN, (DIP)	Digitone, (digipulse) signaling
CFLP	XX	Music Conference Loop

Note: This prompt required only for the first unit defined on each NT5K72AA card.

Technical description

Power requirements

Table 7 lists the power requirements for the NT5K72AA E&M Tie trunk card.

Table 13
NT5K72AA Power requirements

Voltage	Active Current
+/- 15.0 V dc	150 ma
+8.5 V dc	35 ma
+ 5 V dc	110 ma
-48 V dc	80 ma

Environmental specifications

Table 8 provides the environmental specifications for the NT5K72AA E&M Tie trunk card.

Table 14
NT5K72AA Environmental specifications

Parameter	Absolute Limit
Operating temperature	10-45 degrees C, ambient
Operating humidity	20 to 80% RH (non condensing)
Storage temperature	-20 to +60 degrees C

Pad Switching

Attenuation can be selected on a per unit basis in software.

Table 15
Loss values for NT5K72AA E&M trunk card

	Analog-to-Digital	Digital-to-Analog
4-wire E&M		
International Leased line (VNL)	-3.5 dB	+3.5 dB
PBX to PBX (NTC)	-2.5 dB	+4.5 dB
PAG	not applicable	+7.0 dB
RAN/MUS	0 dB	not applicable

Note: The tolerance for the above nominal values is +/- 0.35 dB.

Trunk types description

Each unit on the NT5K72AA E&M Tie trunk card supports:

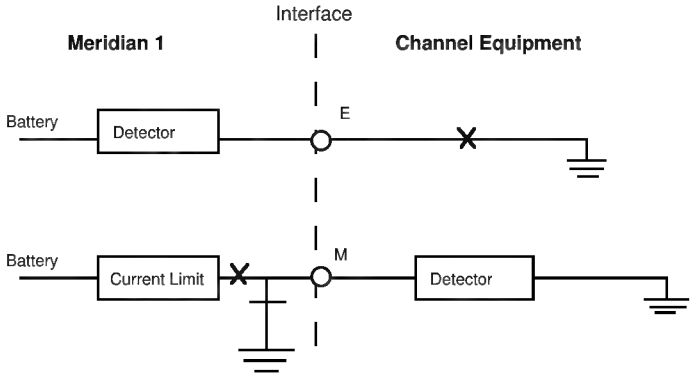
- 4-wire E&M trunk type 1 and 2
- Recorded Announcement (RAN) trunk
- Paging (PAG) trunk
- Music (MUS) trunk

4-wire E&M Type 1 trunk operation

Type 1 E&M operation uses two signaling leads, E and M, that are electrically separated from the associated speech circuit. Signals are sent on the M lead and received on the E lead as shown in Figure 1.

Note: German implementation of type 1 signaling does not allow back to back operation on the NT5K72AA E&M card.

Figure 2
E&M Type 1 signaling



Send signals

All signals are sent by connecting either a battery or ground potential to the M lead. The idle signal is sent by applying ground to the M wire, while the seize signal is sent by applying battery to the M wire.

Receive signals

Signals are received on the E lead by detecting the conditions applied to it by external equipment. An open circuit on the E lead indicates an idle condition, ground on the E wire indicates incoming seize.

Dialing

Digits are sent by applying ground/battery pulses to the M lead (DIP mode only).

Answer

When the called party answers, the far end sends an "answer" signal to the near end E lead.

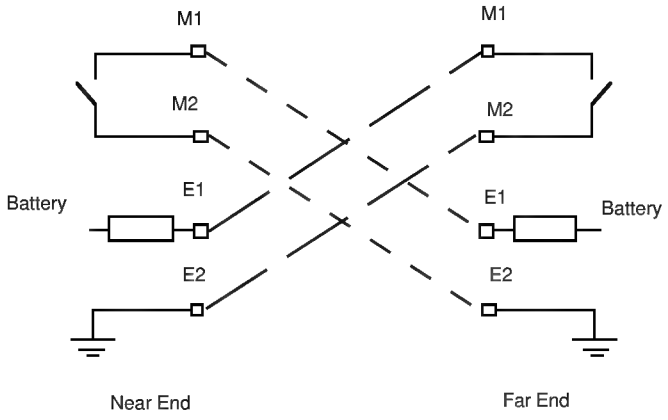
Call disconnect

Either party can disconnect the call by applying a clear signal to the M lead. The far end applies a "clear back" signal, while the near end applies a "clear forward" signal. The circuit remains busy until both clear forward and clear backward signals have been exchanged.

4-wire E&M Type 2 trunk operation

Type 2 E&M operation uses two signaling pairs, E and M, that are electrically separated from the associated speech circuit. Signals are sent on the M pair and received on the E pair as shown in Figure 2.

Figure 3
E&M Type 2 signaling



Send signals

All signals are sent in the form of a contact make or break between the two M leads.

Receive signals

Signals are received on the E lead by detecting the contact make or break applied at the far-end on the M leads.

Idle state

In the Idle state the Option 11 applies an "Idle Signal" to the M leads to indicate that it is available to receive calls.

Seize

To place an outgoing call, the Option 11 at the near end sends a seizing signal through the M leads to the far end. The incoming end (far end) recognizes the seize signal, busies the circuit against outgoing calls, and prepares to receive digits.

Dialing

Digits are sent through the near end M leads in the form of 10 pps pulses of the open-circuit condition.

Answer

When the called party answers, the far end sends an "answer" signal through the M leads.

Call disconnect

Either party can disconnect the call by applying a clear signal to the M leads. The far end applies a "clear back" signal, while the near end applies a "clear forward" signal. The circuit remains busy until both clear forward and clear backward signals have been exchanged.

Table 10 provides a summary of NT5K72AA Type 2 signaling states.

Table 16
Summary of NT5K72AA Type 2 signaling states

Signal	Outgoing PBX sending condition — M Leads	Incoming PBX sending condition — M Leads
Idle	Contact break	Contact break
Seize	Contact make	—
Digit Pulse	Contact break pulses in step with dial pulses	—
Answer	—	Contact make
Clear forward	Contact break	—
Clear back	—	Contact break

Recorded Announcement/Music trunk operation

When used in the Recorded Announcement/Music mode, the trunk circuit is connected to a customer provided recorded announcement machine or a music source.

Machines supported

The NT5K72AA E&M Tie trunk card supports the following types of announcement machines:

- Start mode announcement machines:
- Continuous mode announcement machines

Recorded announcers supported include the Cook Digital 4-channel announcer, the Audichron HQI-112 and the Kreutler-Announcer.

Start mode

In start mode, the E&M Tie trunk card provides a startpulse to the announcement machine to begin playback of the message. The announcement source requires the following:

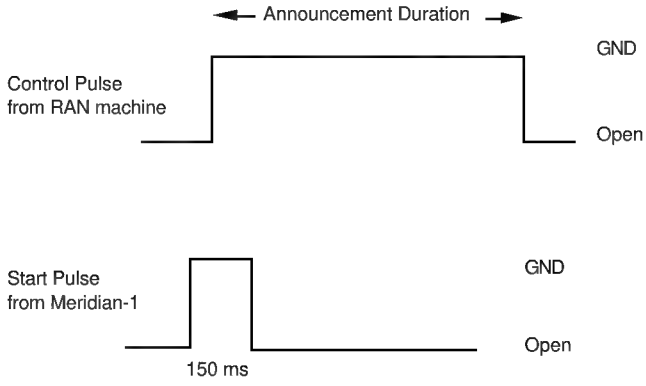
- an impedance of 4 ohms or less
- ground to the trunk unit when playing and an open circuit when idle. This is done through a control lead to the trunk circuit.
- default signal level of -9 dBm (in 600Ω) adjustable to a level of 10 dBm.

To start the announcement, the NT5K72AA E&M Tie trunk card provides a momentary ground signal (150 ms) to the source. The announcement machine should then start playing its message.

The NT5K72AA trunk card expects status information from the announcement machine, that is, whether it is idle or playing. For this reason, the announcement machine requires a control lead to the trunk circuit.

Figure 3 shows recorded announcement in start mode.

Figure 4
Recorded announcement - start mode



Continuous mode

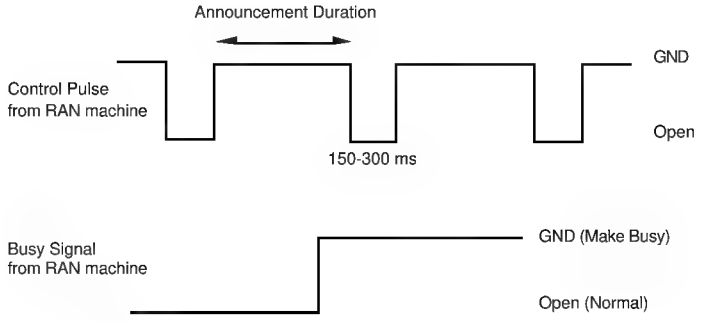
The requirements for continuous mode announcement machines are as follows:

- an impedance of 4 ohms or less
- generation of a control pulse (150 - 300 ms) at the start of the announcement period
- default signal level of -9 dBm (in 600Ω) adjustable to a level of 10 dBm.

The announcement machine may provide a separate busy signal when the machine is recording or erasing a message or if the machine is malfunctioning. The busy signal will be used by the Option 11 for maintenance purposes.

Figure 4 shows recorded announcement in continuous mode.

Figure 5
Recorded announcement - continuous mode



Music source

The music source should provide an impedance of 600 Ω. The default signaling level should be -9 dBm (in 600Ω) adjustable to a level of 10 dBm.

Paging trunk operation

When used in the paging mode, the trunk circuit is connected to a customer-provided paging amplifier system. When accessed, the card provides a loop closure. In a typical application, the loop closure will cut off a music supply and switch the paging trunk transmission path to the paging amplifier.

Direct Inward Dial/Direct Outward Dial trunk card

Functional description

The NT5K36AB Direct Inward Dial/Direct Outward Dial trunk card provides the interface between the Option 11 system and up to four analog trunks. It can be installed in slots 1 to 10 in the main cabinet and in any slot in the expansion cabinet.

Common features

Each NT5K36AB DID/DOD trunk card:

- indicates self-test status during an automatic or manual self-test. Self-test pass is indicated on the faceplate LED.
- converts transmission signals from analog-to-digital and from digital-to-analog for up to 4 audio paths
- disables individual circuits or the entire board under software control
- provides internal 16 kHz pulse detection
- provides transmission performance according to German specifications
- provides the correct signaling impedances and voltages to operate with the German central office.

Physical description

Connections

The NT5K36AB DID/DOD trunk card has four units. Each trunk unit on the card connects to the backplane through an 80-pin connector. The backplane is cabled to the input/output (I/O) panel, and the I/O panel is cabled to the cross-connect terminal.

At the cross-connect terminal, each unit connects to external apparatus by tip and ring leads.

Installation

Table 1 provides cross connect information for the NT5K36 DID/DOD trunk card.

Table 17
NT5K36 DID/DOD Trunk connections

Lead	Pins	Pair color	Unit number
T0 R0	26 1	W-BL BL-W	Unit 0
	27 2	W-O O-W	
	28 3	W-G G-W	
	29 4	W-BR BR-W	
T1 R1	30 5	W-S S-W	Unit 1
	31 6	R-BL BL-R	
	32 7	R-O O-R	
	33 8	R-G G-R	
T2 R2	34 9	R-BR BR-R	Unit 2
	35 10	R-S S-R	
	36 11	BK-BL BL-BK	
	37 12	BK-O O-BK	
T3 R3	38 13	BK-G G-BK	Unit 3
	39 14	BK-BR BR-BK	
	40 15	BK-S S-BK	
	41 16	Y-BL BL-Y	

Trunk configuration

Route Data Block

Each trunk unit on the NT5K36AB DID/DOD card is attached to a route with an associated route data block. The route data block is programmed in LD 16.

Note: All prompts are defaulted except for those noted below. Default values are shown in brackets.

Table 18
LD 16 Route Data Block

Prompt	Response	Comments
REQ	NEW	
TYPE	RDB	Define a new Route Data Block
CUST	0-99	Enter customer number
ROUT	0-127	Enter route number
TKTP	DID	Trunk type is Direct Inward Dial
ICOG	IAO, ICT	Incoming and Outgoing or Incoming only trunk
ACOD	XX	XX=trunk route access code
CNTL	YES	Change controls or timers
TIMR	EOD 10112	Set End of Dial timer to 10112 ms
	ICF 0	Set Incoming Flash timer to 0 ms
	OGF	Set Outgoing Flash timer to 0 ms
	GTI 128	Set Guard Timer Incoming to 128
	GTO 2048	Set Guard Timer Outgoing to 2048
	DSI 360000	Set Disconnect Timer to 360000 ms (6 minutes)
NEDC	ETH	Near end disconnect control from either end

— Continued —

Prompt	Response	Comments
FEDC	ETH	Far end disconnect control from either end
PRDL	BSY	Return Busy Tone on partial dial timeout
EOS	BSY	Send End of Selection (number received) signal and Busy signal if required
ACKW	YES	Seize acknowledge required
BTT	100	Busy tone timer 100 seconds

Trunk Data Block

Use overlay 14 to configure each of the four trunk units on the NT5K36AB DID/DOD trunk card. Default values are shown in brackets.

Table 19
LD 14 Route Data Block

Prompt	Response	Comments
REQ	NEW	Define a new trunk unit
TYPE	DID	Direct Inward Dial
TN	CC UU	Terminal number of the unit in Option 11 format Card, Unit
XTRK (see note)	XDID	Type is IPE DID
SIGL	EAM	EAM type signaling
STRI	IMM	Incoming start is immediate dial
STRO	IMM	Outgoing start is immediate dial
SUPN	NO	Answer and disconnect supervision required
CLS	SHL, (LOL)	Attenuation pads in, (out)

Note: This prompt is required only for the first unit defined on each NT5K36AB card.

Self-test

When the card is installed, the red Light Emitting Diode (LED) on the faceplate flashes as the self-test runs. If the self-test completes successfully, the card is automatically enabled (if it has been configured in software) and the LED goes out. If the self-test fails, the LED will remain lit.

Technical description

The technical details of the NT5K36AB Direct Inward Dial/Direct Outward Dial trunk card are given in this section.

Power requirements

Table 4 lists the power requirements for the NT5K36AB DID/DOD trunk card.

Table 20
NT5K36AB power requirements

Voltage	Active current
+15 V dc	306 ma
-15 V dc	306 ma
+8.5 V dc	250 ma
-48 V dc	378 ma
+ 5 V dc	150 ma

Note: The maximum allowable current imbalance between the +/- 15V rails is 100 ma per circuit card.

Environmental specifications

Table 5 lists the environmental specifications for the NT5K36AB DID/DOD card.

Table 21
NT5K36AB Environmental specifications

Parameter	Recommended temperature/humidity
Operating temperature	0 to +45 degrees C
Storage temperature	- 45 to +70 degrees C
Operating humidity	10 to 95% relative humidity
Storage humidity	0 to 95% relative humidity

PAD switching

Loss values for the NT5K36AB DID/DOD card are given in Table 6.

Table 22
NT5K36AB PAD switching

	Short Line	Long Line
Analog-to-Digital loss	-5 dB	-7 dB
Digital-to-Analog loss	+2 dB	0 dB

Note: Tolerance for the above nominal values is +/- 0.55 dB.

Direct Inward Dial/Direct Outward Dial description

This section describes the signaling of the NT5K36AB DID/DOD trunk card. Signaling is explained by using "state tables", which outline the potentials or impedances required at the central office or Option 11 for various call states.

For the "state tables" provided in this section, the following items apply:

- "Current feed number" refers to the feed diagrams outlined in German Regulatory Requirement FTZ 123R1 (Oct 89) part 13, section 4.
- Resistance values represent the resistances applied to analog ground on a given wire by the Option 11 or the central office.

Central office types supported

The NT5K36AB DID/DOD card supports three central office types: IKZ1, IKZ2, and IKZ3. Central offices IKZ1 and IKZ2 interact with the NT5K36AB trunk card by presenting specific voltages and resistances. Central office IKZ3 interacts with the NT5K36AB by presenting specific current feeds.

Modes of operation

Each unit on the NT5K36AB DID/DOD card is capable of operating as a DID/DOD trunk. There are three modes of operation for the NT5K36AB circuit card:

- Outgoing calls placed by Option 11
- Short distance incoming calls from the central office
- Long distance incoming calls from the central office.

Outgoing calls

Idle state

The condition of the Option 11 and the central office in the idle state is given in Table 7.

Table 23
Idle state

	Option 11		Central Office (CO) (IKZ 1,2)		CO (IKZ 3)
Wire	**Voltage**	**Resistance**	**Voltage**	**Resistance**	**Resistance/ Feed**
Tip	Ground	greater than 13 K	-60	0.8 to 1.1K	current feed 1
Ring	-60	0.6 to 1.2 K	Ground	greater than 13.1K	13 to 300K

Outgoing Seize

Table 8 shows the condition of the Option 11 and the central office when the Option 11 seizes a circuit to place an outgoing call.

Table 24
Outgoing seize

	Option 11		Central office (CO) (IKZ 1,2)		CO (IKZ 3)
Wire	**Voltage**	**Resistance**	**Voltage**	**Resistance**	**Resistance/ Feed**
Tip	Ground	less than 0.8K	-60	0.8 to 1.1K	current feed 3
Ring	-60	0.6 to 1.2K	Ground	greater than 13.1K	13 to 300K

Seizure acknowledge

The central office acknowledges seizure by the Option 11, as shown in Table 9.

Table 25
Outgoing seizure acknowledge

	Option 11		Central office (CO) (IKZ 1,2)		CO (IKZ 3)
Wire	**Voltage**	**Resistance**	**Voltage**	**Resistance**	**Resistance/ Feed**
Tip	Ground	less than 0.8K	Ground	less than 1.1K	balanced loop
Ring	-60	0.6 to 1.2K	-60	0.9 to 1.5K	current feed 6

Option 11 low impedance loop

When the Option 11 receives the seizure acknowledge signal, it places a low resistance dc loop across the tip and ring leads.

Table 26
Option 11 low impedance loop

	Option 11		Central office (CO) (IKZ 1,2)		CO (IKZ 3)
Wire	**Voltage**	**Resistance**	**Voltage**	**Resistance**	**Resistance/ Feed**
Tip	—	dc loop of less than .44KK	Ground	0.8 to 1.1K	balanced loop
Ring	—		-60	0.9 to 1.5K	current feed 6

Dial tone from central office

The central office provides dial tone to the Option 11 (425 or 450 Hz +/- 10%). The states of the Option 11 and the central office during dial tone are given in Table 11.

Table 27
Dial tone from central office

	Option 11		Central office (CO) (IKZ 1,2)		CO (IKZ 3)
Wire	**Voltage**	**Resistance**	**Voltage**	**Resistance**	**Resistance/ Feed**
Tip	—	dc loop less than 0.44K	Ground	0.42 to 0.55K	balanced loop
Ring	—		-60	0.42 to 0.55K	current feed 6

Dialing

If a dial tone detector is present on the Option 11 system, the detector will ensure that valid dial tone from the central office is present for more than one second. The Option 11 is then ready to sent digits to the central office. (If no dial tone detector is present, the Option 11 is ready to send digits as soon as dial tone is received from the central office).

The Option 11 sends digits in the form of outpulsing. One digit consists of a pulse plus a pause. In the pulse condition, a high resistance loop of greater than 100K is placed across the tip and ring leads. In the pause condition, a dc loop of less than 0.22K is present across the tip and ring leads.

Ringing (called line free)

When a call is ringing through to the far end, the central office provides a "line free" tone to the Option 11. The states of the Option 11 and the central office are as the same as outlined in Table 11.

Busy (called line busy)

If the called party is busy and cannot take the call, the central office provides the Option 11 with busy tone. The states of the Option 11 and the central office are given in Table 11.

Answer

When the call is answered, the central office applies metering pulses. The pulses are detected by the PPM detector and counted by the on-board microprocessor.

The NT5K36AB trunk card supports both buffered and unbuffered PPM:

- in the case of unbuffered PPM, a valid pulse is passed on to the central processing unit (CPU) as soon as it is detected.
- In the case of buffered PPM, the NT5K36AB microprocessor counts 256 pulses before passing an "overflow" to the CPU. The residual count (less than 256) is passed to the CPU when requested at the end of a call.

The states of the Option 11 and the central office are given in Table 11.

Option 11 call disconnect

The Option 11 has control over call disconnect; far end release is not possible. To disconnect the call, the Option 11 removes the dc loop between the tip and ring leads and returns to the idle state.

The central office will return to the idle state when it receives the clear back signal from the Option 11. If the central office does not return to the idle state within one second of the Option 11 going idle, the NT5K36AB DID/DOD card will go into a troubled state and will try to force a release.

Short distance incoming calls

Idle state

The idle state is given in Table 7.

Incoming seize

Table 12 shows the condition of the Option 11 and the central office when the central office seizes a circuit for an incoming call.

Table 28
Incoming seize

	Option 11		Central office (CO) (IKZ 1,2)		CO (IKZ 3)
Wire	**Voltage**	**Resistance**	**Voltage**	**Resistance**	**Resistance/ Feed**
Tip	Ground	greater than 13K	-60	0.8 to 1.1K	current feed 1
Ring	-60	0.6 to 1.2K	Ground	0.35 to 0.55K	0.35 to 0.45K

Seizure acknowledge

The Option 11 acknowledges seizure by the central office, as shown in Table 13.

Table 29
Incoming seizure acknowledge

	Option 11		Central office (CO) (IKZ 1,2)		CO (IKZ 3)
Wire	**Voltage**	**Resistance**	**Voltage**	**Resistance**	**Resistance/ Feed**
Tip	-60	greater than 0.5K	-60	0.8 to 1.1K	current feed 1
Ring	Ground	open circuit	Ground	0.35 to 0.55K	0.35 to 0.45K

Waiting for dial pulses

After seizure acknowledgment, the Option 11 waits for dial pulses from the central office.

Table 30
Waiting for dial pulses

	Option 11		Central office (CO) (IKZ 1,2)		CO (IKZ 3)
Wire	**Voltage**	**Resistance**	**Voltage**	**Resistance**	**Resistance/ Feed**
Tip	-60	greater than 0.5K	—	dc loop 6.5 to 110K with 1.5 µF in parallel	dc loop of 7 to 110K
Ring	Ground	greater than 90K	—		

Receiving digits

The central office sends digits by applying ground pulses on the tip lead. During the first dial pulse of each digit, the Option 11 switches in a "long distance detector" on the ring lead. The first dial pulse is shown in Table 15.

After the first dial pulse, the long distance detector is removed. Subsequent dial pulses are shown in Table 16. Table 17 shows the pause state.

Table 31
First dial pulse

	Option 11		Central office (CO) (IKZ 1,2)		CO (IKZ 3)
Wire	**Voltage**	**Resistance**	**Voltage**	**Resistance**	**Resistance/ Feed**
Tip	-60	greater than 0.5K	Ground	0.02K	0.05K
Ring	Ground	greater than 12.7K	potentials as for Table 3-14	potentials as for Table 3-14	potentials as for Table 3-14

Table 32
Subsequent dial pulses

Wire	Option 11		Central office (CO) (IKZ 1,2)		Central office (IKZ 3)
	Voltage	**Resistance**	**Voltage**	**Resistance**	**Resistance/ Feed**
Tip	-60	greater than 0.5K	Ground	0.02K	0.5K
Ring	Ground	greater than 90K	potentials as for Table 3-14	potentials as for Table 3-14	potentials as for Table 3-14

Table 33
Pause

Wire	Option 11		Central office (CO) (IKZ 1,2)		CO (IKZ 3)
	Voltage	**Resistance**	**Voltage**	**Resistance**	**Resistance/ Feed**
Tip	-60	greater than 0.5K	open circuit	—	open circuit
Ring	Ground	greater than 90K	potentials as for Table 3-14	potentials as for Table 3-14	potentials as for Table 3-14

Ringing (called line free)

If the trunk circuit called is free, the Option 11 will provide the central office with ringback tone. The states of the Option 11 and the central office are given in Table 14.

Busy (called line busy)

If the trunk circuit called is busy, the Option 11 provides the central office with busy tone. The states of the Option 11 and the central office is given in Table 14.

Answer

When the called party answers, the Option 11 reverses the battery on the tip and ring leads and a speech path is established.

Table 34
Speech state

	Option 11		Central office (CO) (IKZ 1,2)		CO (IKZ 3)
Wire	**Voltage**	**Resistance**	**Voltage**	**Resistance**	**Resistance/ Feed**
Tip	Ground	90 to 300K	—	dc loop 6.5 to 110K with 1.5 µF in parallel	dc loop less than or equal to 110K
Ring	-60	0.65 to 0.85K	—		

Option 11 call disconnect

The Option 11 disconnects the call by applying ground pulses to the tip lead. The central office sends a 50 Hz release signal to the Option 11. The Option 11 then returns to the idle state.

If the central office does not send a release signal within 5 minutes of the Option 11 applying ground pulses, the DID/DOD trunk card goes into a troubled state and attempts to force a release.

Central office disconnect

The central office disconnects the call by sending a 50 Hz (90 Vrms) release signal. The Option 11 detects the signal and returns to the idle state.

Long distance incoming calls

Idle state

The idle state is given in Table 11.

Incoming seize

Incoming seize for long distance calls is the same as given in Table 12.

Seizure acknowledge

Seizure acknowledge for long distance calls is the same as given in Table 13.

Waiting for dial pulses

The waiting for dial pulse condition is given in Table 14.

Receiving digits

The central office sends digits by applying ground pulses on the tip lead. During the first dial pulse of each digit, the Option 11 switches in a "long distance detector" on the ring lead.

For long distance calls, the central office sends a long distance signal at the beginning of the first dial pulse of each digit. This signal informs the Option 11 that an end of selection (EOS) signal is required.

The long distance signal is shown in Table 19.

Table 35
Long distance signal

	Option 11		Central office (CO) (IKZ 1,2)		CO (IKZ 3)
Wire	**Voltage**	**Resistance**	**Voltage**	**Resistance**	**Resistance/ Feed**
Tip	-60	greater than 0.5K	Ground	0.02K	0.5K
Ring	Ground`	greater than 12.7K	-60	less than or equal to 0.66K	current feed 1

After sending the long distance signal, the central office returns to the state shown in Table 15. If no pulse is received, the call continues a short distance call (see previous section).

If a dialing timeout occurs, Option 11 software sends an end of selection (EOS) signal and an EOS/Busy signal. The call continues as a busy extension.

End of selection (EOS) signal

After the last valid dial pulse has been received, the Option 11 sends an End of selection (EOS) signal. This signal informs the central office that the routing data has been received or that a dial timeout has occurred. The EOS signal is shown in Table 20.

Table 36
EOS signal

	Option 11		Central office (CO) (IKZ 1,2)		CO (IKZ 3)
Wire	**Voltage**	**Resistance**	**Voltage**	**Resistance**	**Resistance/ Feed**
Tip	Ground	0.65 to 0.85K	—	dc loop 6.5 to 110K with 1.5 µF in parallel	dc loop of 7 to 9K
Ring	-60	0.65 to 0.85K	—		

End of dialing

When dialing is complete, the Option 11 enters the state given inTable 21. After this state, the trunk switches to the ringing condition or sends a busy signal, depending on the status of the called party.

Table 37
End of dialing

	Option 11		Central office (IKZ 1,2)		CO (IKZ 3)
Wire	**Voltage**	**Resistance**	**Voltage**	**Resistance**	**Resistance/ Feed**
Tip	-60	greater than 0.5K	—	dc loop 6.5 to 110K with 1.5 µF in parallel	dc loop of 7 to 9K
Ring	Ground	greater than 90K	—		

Ringing (called line free)

If the called line is free, the Option 11 provides ringing tone. The states of the Option 11 and the central office are given in Table 21.

Busy (called line busy)

If the called line is busy, a busy signal is sent to the central office. Table 22 shows the busy signal.

Table 38
Busy signal

	Option 11		Central office (IKZ 1,2)		CO (IKZ 3)
Wire	**Voltage**	**Resistance**	**Voltage**	**Resistance**	**Resistance/ Feed**
Tip	Ground	0.65 to 0.85K	—	dc loop 6.5 to 110K with 1.5 µF in parallel	dc loop of 7 to 9K
Ring	-60	0.65 to 0.85K	—		

After sending the busy signal, the Option 11 switches to the state given in Table 21 and provides busy tone to the central office.

Answer

When the called party answers, the Option 11 switches to the state given in Table 22 for 100 to 180 ms. After this state, the call proceeds as a short distance call (see Table 18).

Option 11 call disconnect

The Option 11 disconnects the call by applying ground pulses to the tip lead. The central office detects the signal and sends a release signal to the Option 11. The Option 11 then returns to the idle state.

If the central office does not send a release signal within 5 minutes of applying ground, the DID/DOD trunk card goes into a troubled state and attempts to force a release.

Central office disconnect

The central office disconnects the call by sending a 50 Hz release signal. The Option 11 detects the signal and returns to the idle state.

Troubled or barred condition

When normal call progression does not take place, the Option 11 will attempt to force the central office into an idle state. The Option 11 accomplishes this by sending trigger pulses to the central offices, as shown in Table 23.

Table 39
Trigger pulses from Option 11

	Option 11		Central office (IKZ 1,2)		CO (IKZ 3)
Wire	**Voltage**	**Resistance**	**Voltage**	**Resistance**	**Resistance/ Feed**
Tip	Ground	greater than 13K	Any state	except idle	
Ring	-60	0.6 to 1.2K			

After sending the trigger pulses, the Option 11 will wait 80 to 1000 ms for the central office to return to the idle state or send a release signal. When this happens, the Option 11 will return to the idle state.

If the central office does not go idle or send a release signal, the Option 11 will continue to send trigger pulses until an idle state or release signal is detected.

Troubled state

The conditions which will force the Option 11 to enter the troubled state are as follows:

- The central office does not go idle or send a release signal within five minutes of the Option 11 releasing an incoming call.
- The central office does not return to the idle state within one second of the Option 11 releasing an outgoing call.
- The central office removes battery from the tip wire during the idle state.
- The central office does not release a call within one minute of the call terminating on a busy or invalid station.

Call bar state

If any of the four conditions mentioned above occur, an alarm signal is sent to the central processing unit (CPU). The CPU interprets the signal as a line break and sends a TRK501 message to the teletype (TTY) or lights a lamp on the console. Hardware busies the trunk against outgoing calls. The status of the trunk in overlay 32 is "Busy Barred".

The trunk can be disabled while it is in the busy barred state. However, if it is enabled before the fault is cleared, an error message will be generated. When the fault condition is cleared, a TRK502 message is send to the TTY and the software and hardware are placed in the idle state.

Direct Inward Dial Auto Answer Circuit (DID Tester)

Functional description

The NT5K92AA Direct Inward Dial (DID) Auto Answer Circuit is used to test the condition of the DID lines on an Option 11 system. It does the following:

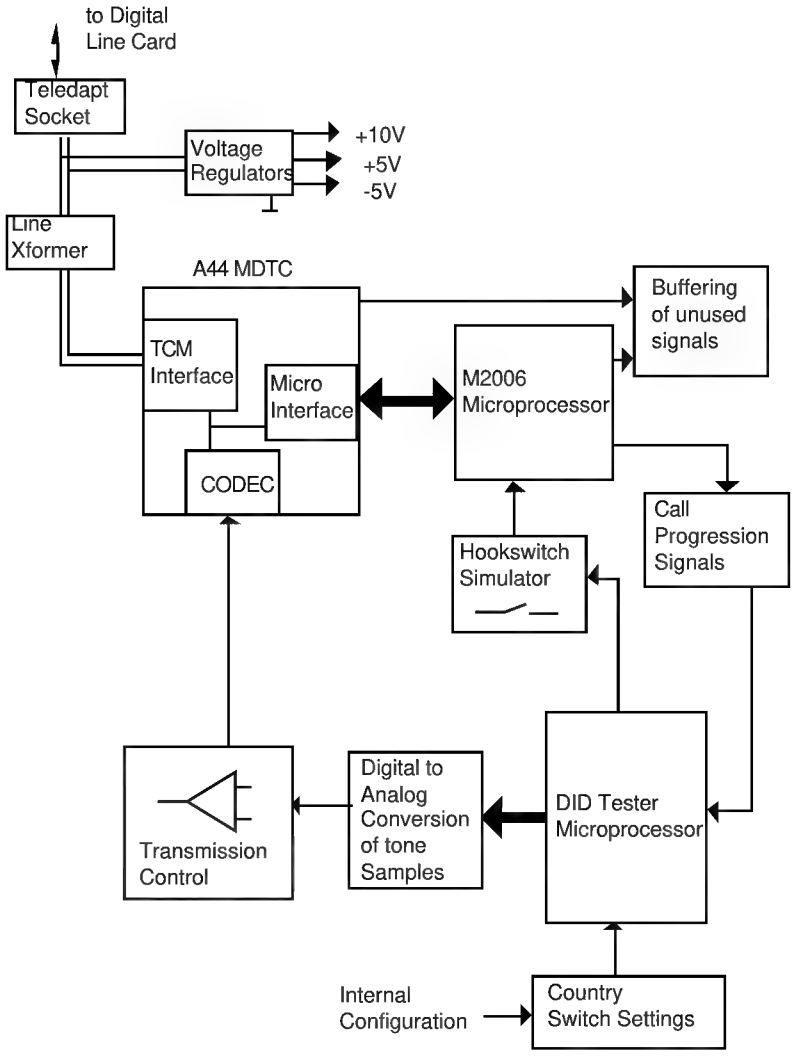
- answers an incoming DID call
- holds the call for a predetermined length of time
- sends tones or remains silent, then
- disconnects the call.

Note: specific operational requirements for Austria are given at the end of this section.

If the DID Auto Answer Circuit can not be accessed, or if any part of the test fails, the DID card is assumed to be faulty.

Figure 1 provides a block diagram of the NT5K92AA Auto Answer Circuit.

Figure 6
NT5K92AA Block diagram



Common features

The NT5K92AA Auto Answer Circuit has the following features:

- supports the NT5K36AB German DID card for systems using intelligent peripheral equipment (IPE). (The NT5K36AB DID card is described in the previous section of this document).
- supports the NTD9878 DID card for systems using existing peripheral equipment (EPE).
- provides an option switch for selecting the country of operation (Austria, Switzerland or Belgium)
- connects to a single unit of a digital line card (DLC) or integrated services digital line card (ISDLC).
- processes an incoming call in the same manner as an M2006 meridian modular telephone
- has its own pre-defined directory number (DN).

Physical description

The NT5K92AA DID Auto Answer circuit consists of a circuit card packaged in a plastic box. It can be mounted on the floor using four anti-static feet, or it can be mounted on the wall next to the cross connect terminal. The NT5K92AA measures as follows:

Length	Width	Depth (with feet)
250 mm (1 in.)	132 mm (5.2 in.)	42 mm (1.7 in.)

Switch settings

An option setting on the NT5K92AA configures the tester for one of three countries of operation: Austria, Switzerland, or Belgium. The switch is located on the circuit board inside the plastic box.

To set the option switch, follow the steps given below:

- make sure the NT5K92AA DID Auto Answer circuit is not connected to the Option 11 system.
- turn the NT5K92AA unit upside-down so that the bottom is facing up.
- remove the four screws located on each corner of the box. Remove the base cover.
- set switch S1 according to the country of operation:

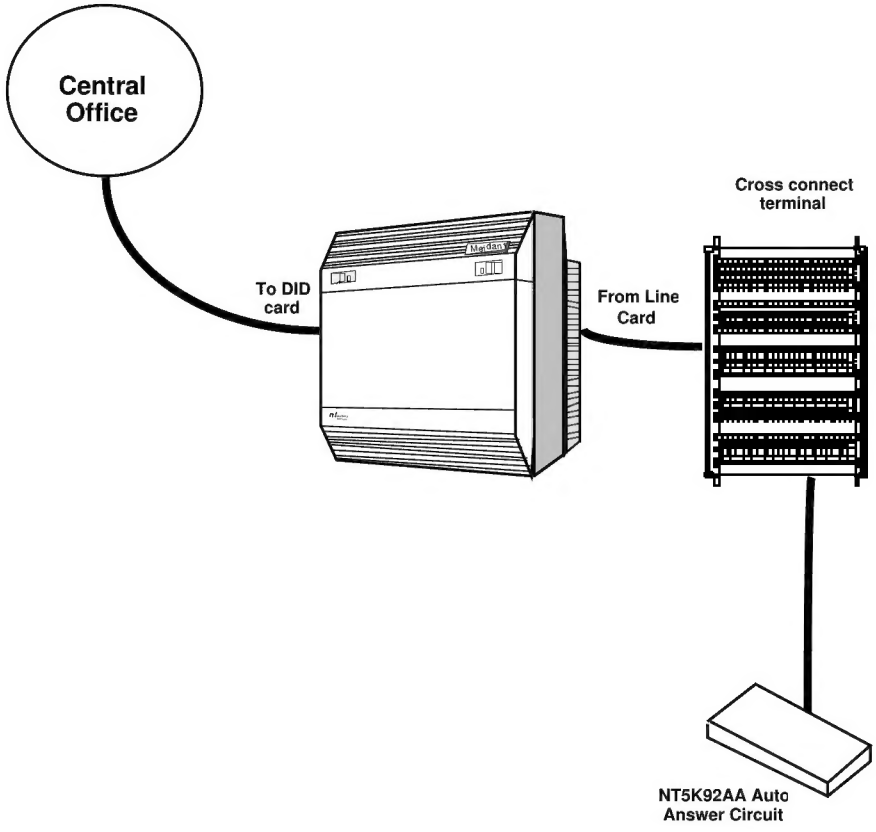
Country	**Switch S1 0=OFF1=ON**			
	1	2	3	4
Austria	0	0	1	0
Switzerland	0	0	0	1
Belgium	0	1	0	0

- replace the base cover and re-insert the four screws.

Connections

The NT5K92AA DID Auto Answer Circuit connects to a single unit of a digital line card (DLC) or integrated services digital line card (ISDLC). Figure 2 provides an overview of NT5K92AA connections.

Figure 7
NT5K92AA DID Auto Answer Circuit connections



Cabling

To install the NT5K92AA Auto Answer Circuit, use a teledapt cable, as when wiring an M2006 telephone.

Software configuration

The NT5K92AA Auto Answer Circuit is configured as an M2006 Meridian modular telephone. The extension number used is provided by the German regulatory authority.

To configure the NT5K92AA Auto Answer Circuit, use overlay 11. All prompts are default except for those given in Table 1.

Table 40
Configuring NT5K92AA in LD 11

Prompt	Response	Comments
REQ	NEW	Define a new digital telephone set
TYPE	2006	Digital set type M2006
KEY	0 SCR XXXX	Key 0, Single Call Ringing, XXXX=extension number

LED indicators

There are two LEDs, one red and one green, located on the front of the NT5K92AA Auto Answer Circuit. Table 2 provides a summary of the NT5K92AA LEDs.

Table 41
NT5K92AA LEDs

LED	State	Description
Red	Lit	NT5K92AA is connected to digital line card and is drawing power from it
Green	Off	NT5K92AA is idle
	Flashing	Incoming call present
	Lit	Call has been answered

Technical description

The technical requirements of the NT5K92AA Auto Answer Circuit are outlined below.

Power requirements

The NT5K92AA Auto Answer Circuit draws power from the +/- 15V rails supplied by the digital line card. The maximum power draw required is 60 ma.

The 30V from the line card is regulated to provide the +10V, +5V, -5V and ground used to power the internal circuitry of the NT5K92AA Auto Answer Circuit.

Environmental specifications

Table 3 provides the environmental requirements for the NT5K92AA Auto Answer Circuit.

Table 42
NT5K92AA Environmental specifications

Parameter	Recommended temperature/humidity
Operating temperature	0 to +45 degrees C
Storage temperature	- 45 to +70 degrees C
Operating humidity	10 to 95% relative humidity
Storage humidity	0 to 95% relative humidity

German operational requirements

Signaling for the NT5K92AA Auto Answer circuit is the same as for a digital set. In Austria, the NT5K92AA Auto Answer Circuit does the following:

- detects an incoming call from the digital line card
- answers the incoming call within 100 ms of the DID card sending the "End of Selection" (EOS) signal to the central office. The call is answered by sending an answer message to the digital line card.
- holds the call for 3 seconds (plus or minus 1 second) after the call has been answered
- disconnects the call by sending a release message to the digital line card.

Typical settings for Sweden are as follows:

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